The Accuracy of Current GNSS Signal Sources for Radio Occultation Missions

Erin Griggs\textsuperscript{1}, E. Robert Kursinski\textsuperscript{2}, Dennis Akos\textsuperscript{1}

\textsuperscript{1}University of Colorado, Boulder, CO
\textsuperscript{2}Moog Advanced Missions and Science, Golden, CO

Abstract

GNSS RO utilizes the various navigation satellite systems as signal sources for atmospheric remote sensing. The frequency stability of the signals emitted by GNSS satellites is tied to the stability of the atomic frequency standards (AFS) they carry onboard and is thus critical to the quality of the atmospheric profiles derived from the occultation measurements. Because of the variety of AFS used by different GNSS constellations, we have undertaken a comprehensive study to characterize the stability of the signal sources at the time scales relevant to RO.

In this study, we characterize the short-term (\(\leq 100\) second) stability of the various GNSS satellite AFS in terms of modified Allan deviation. In contrast to our previous study [1], we use active hydrogen masers at NIST and JPL as the AFS for the GNSS receiver. This allows us to better assess the stability of the new GPS Block IIF Rubidium clocks and Galileo Passive Hydrogen Masers without using the three-cornered hat technique as well as assess the accuracy of the three-cornered hat technique. The Galileo and BeiDou frequency references show better stability for occultation applications, in terms of Allan deviation, than the current GPS constellation. The signals from many of the GLONASS satellites exhibit relatively large short-term instabilities that appear to require sub-second clock corrections in order to achieve occultations of a quality comparable to that of present GPS and the other AFS.